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ABSTRACT

Using a sample of 77 10th grade boys, the researchers studied the relationships between the mental abilities measured by the Differential Aptitude Tests and cerebral dominance (CD: the extent to which one hemisphere of the brain dominates the other for control of behavior). The surprise finding was that CD was negatively related to spatial relations abilities. Previous research, though scanty, has suggested a positive relationship. Possible reasons for the discrepancies among the findings are offered. (Author)

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The Relationships Between Cerebral Dominance
and Different Mental Abilities

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Abstract

Using a sample of 77 10th grade boys, the researchers studied the relationships between the mental abilities measured by the Differential Aptitude Tests and cerebral dominance (CD: the extent to which one hemisphere of the brain dominates the other for control of behavior). The surprise finding was that CD was negatively related ($r = -.31$, $p < .05$) to spatial relations abilities. Previous research, though scanty, had suggested a positive relationship. Possible reasons for the discrepancies among the findings are offered.

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The Relationships Between Cerebral Dominance and Different Mental Abilities

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After decades of interest in the factor structure of performances on mental tests (Burt, 1969; Guilford, 1967; Horn & Cattell, 1966; Thurstone, 1938; Vernon, 1950), some researchers have begun to relate neurophysiological variables to test score data. Reviews of many such studies are presented in Matarazzo (1972). Among the neurophysiological variables receiving attention is 'cerebral dominance'.

The term 'cerebral dominance' (CD) means the degree to which one hemisphere of the brain dominates the other for control of behavior. In most people one or the other cerebral hemisphere is dominant to some degree. This results in the phenomena of handedness, footedness and eyedness. The dominance of the left hemisphere causes most people to favor their right sides, because the left hemisphere controls the right side of the body.

A small body of evidence has been accumulating which suggests that at least some mental abilities may be related to the degree of cerebral dominance. Knowing that, in general, right-handed people show more cerebral dominance than left-handed people, Levy (1969) compared 10 sinistral with 15 dextral graduate students. While the groups did not differ on the verbal portion of the WAIS, the dextrals did better by .5SD on the performance portion.

Levy hypothesized that analytic language functions and synthetic perception functions were antagonistic. Hence, evolutionary development has resulted in the observed (Sperry, 1973) separation of functions in the two hemispheres, with the left hemisphere usually carrying on with the analytical, numerical, and language tasks while the right hemisphere performs the perceptual and non-verbal tasks. Where dominance is incomplete, Levy argues that interference causes the functioning of the minor hemisphere to suffer. It is not clear, however, why the spatial, perceptual functions should suffer more from interference than the analytical, language functions. One could also argue that the phylogenetically newer language functions should suffer more from interference.

More recently, Sperry (1973) concluded a review of his work with patients whose cerebral hemispheres had been surgically separated by saying that, in general, cerebral dominance and specialization appeared to be good things. The specific ways in which dominance affects an individual have not been well explored, however.

Finally, Berman (1971) reported an amazing correlation of .81 between scores on the Columbia Mental Maturity Scale (CMMS: a nonverbal intelligence test) and his own Index of Cerebral Dominance (ICD). The sample consisted of 60 normal children between the ages of 8 and 14. The reported correlation seems improbably high, especially when one considers the fact that the CMMS is intended for use only with children under the age of 10.

The purpose of this study was to elaborate on the findings of these researchers using a new measure of cerebral dominance and a complete battery of mental ability tests. We wished to document the ways in which different mental abilities are related to cerebral dominance.

Method

Seventy-seven 10th grade boys attending two private Catholic secondary schools in the Boston area served as subjects for this investigation. The Ss had recently taken the Differential Aptitude Tests as part of the guidance program, but the Ss and their scores were unknown to the researchers. As would be expected, these Ss were generally of above average ability. The mean scores for both groups fell at approximately the 65th percentile.

A cerebral dominance measure was constructed by the researchers who used Berman's (1971,1973) IGD as a model. The present measure consisted of 24 items instead of Berman's 108, and the coefficient alpha reliability was .77 for this measure as compared to the test-retest reliability of .84 reported by Berman (1973). We believed that the economy gained with a shortened instrument outweighed the small loss in reliability.

Each S was administered the dominance measure individually. The procedure took approximately 15 minutes per S, and the Ss were required to do things like hop on one foot, throw darts, and sight a target through a tube. After the testing was completed, the investigators obtained the DAT scores of each student. The DAT consists of eight separate tests: Verbal Reasoning (VR), Numerical Ability (NA), Abstract Reasoning (AR), Clerical Speed and Accuracy (CL), Mechanical Reasoning (MR), Spatial Relations (SR), Spelling (SP), and Language Usage (LU). In addition, a general aptitude score is reported as the sum of VR and NA.

The data were analyzed by correlating cerebral dominance (CD) scores with DAT scores. A number of Ss were excluded from the analysis because of developmental difficulties or special training in the use of one side of the body or the other. For instance, left-handed Ss who had been forced in school to write with the right hand, and Ss who had suffered serious athletic injuries to the legs, arms, or eyes, were excluded. In addition, some Ss had not yet taken all of the DAT subtests. Hence, the correlations reported below are based on somewhat different Ns.

Results

The correlations observed in this sample are presented below:

		<u>VR</u>	<u>NA</u>	<u>V+N</u>	<u>AR</u>	<u>MR</u>	<u>SR</u>	<u>SP</u>	<u>LU</u>
CD	r	-.04	.08	.01	-.08	-.14	-.31*	.27	.02
	N	64	63	63	45	59	46	45	45

* $p < .05$

The two groups responded to the Clerical Speed and Accuracy test on different types of answer sheets. Since the type of answer sheet used is known to affect these scores (DAT Manual, 1974), these scores were analyzed separately by school. The CD-CL correlations were not statistically significant at the .05 level.

The only significant correlation was between CD and SR. People showing less dominance tended to perform better on spatial relations tasks, and people showing more dominance performed worse.

Discussion

The small body of existing research prepared us to expect SR to be related to CD, but our expectations were for a positive relationship. Interestingly, handedness (scored left = 1, right = 3) correlated $-.20$ ($N = 46$) with SR. While this r is not significant, its sign is in agreement with the CD-SR correlation. Both of these findings contradict those of Levy (1969) and Berman (1971). Clearly, this study must be replicated, but we do have great confidence in the quality of the data gathered for this investigation. We suspect that the reason for the discrepancies in the findings may lie in the samples investigated and the particular measures used. In any case, we are presently collecting additional data and within the year will have an expanded data base with which to confirm or modify our conclusions.

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